

Oceans and Ecosystems Research

The Florida Area Coastal Environment

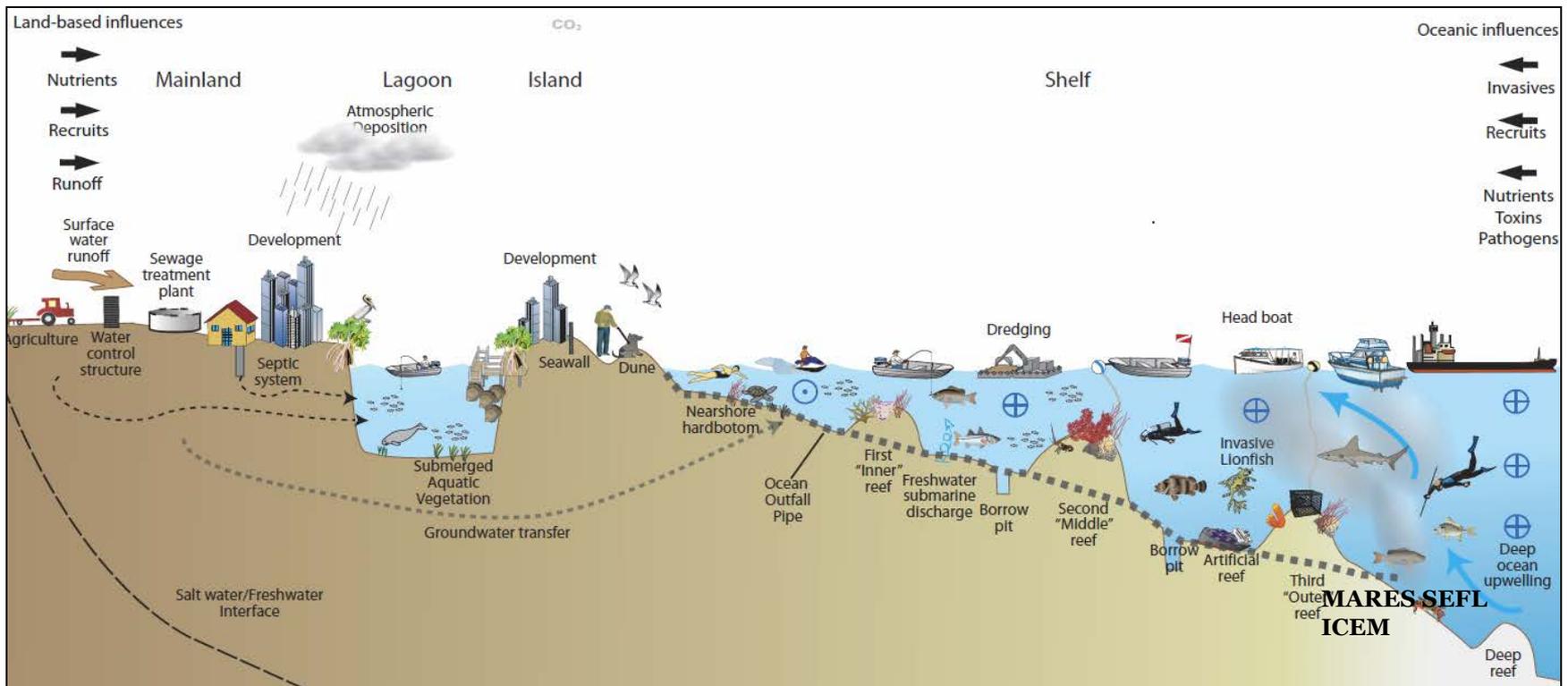




The Florida Area Coastal Environment program seeks to develop an understanding of chemical, physical and biological processes both natural and anthropogenic, that impact coastal ecosystems.

- **What are the sources, concentrations and dispersion patterns of nutrients, pathogens, and fecal indicators in coastal waters?**
- **Are there detectable changes in the coastal ecosystems relatable to anthropogenic nutrients or pathogens?**
- **Is there a nutrient threshold level above which the ecosystem will begin to experience degradations.**

Like many coastal ecosystems throughout the world, the Southeast Florida ecosystem is relied upon to provides many services and is subjected to many pressures. Unique to the other states, this region contains extensive coral reefs tracts. These tracts contain many species such as soft corals, sponges, and hard corals including several endangered *Acropora* species. The decline of these corals has been associated with changes in the chemical environment of the ecosystem. Inputs into the ecosystem include discharge from inlets and treated-wastewater outfalls, city runoff, groundwater discharge, ocean upwelling and atmospheric deposition. This program seeks to quantify these sources.



Partnerships and Stakeholders

Through, publications, public meetings and participation in the Southeast Florida Coral Reef Initiative (SEFCRI) we are able disseminate information from our efforts and maintain a working relationship with a number of governmental and non-governmental stakeholders in the Southeast Florida region.



US Army Corps of Engineers®



Nutrients from Coastal Inlets

On each ebb tide, a significant amount of nutrients and microbes are transported from inland waters to the coastal ocean. To quantify this, measurements of the ebb tidal prism are made concurrently with measurements of nutrient and microbial concentrations .



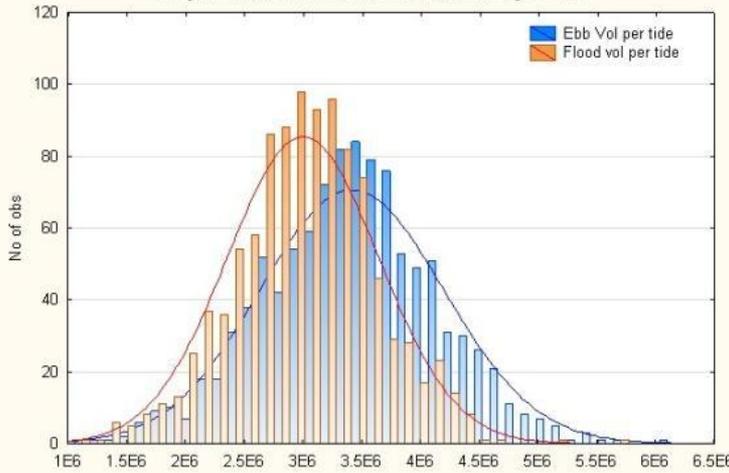
Port Everglades Inlet
during dredging operations



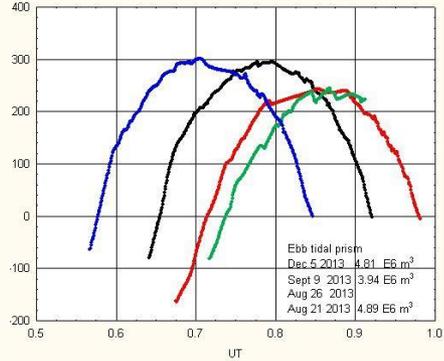
Boynton Inlet

To date, four coastal inlets in South Florida have been studied

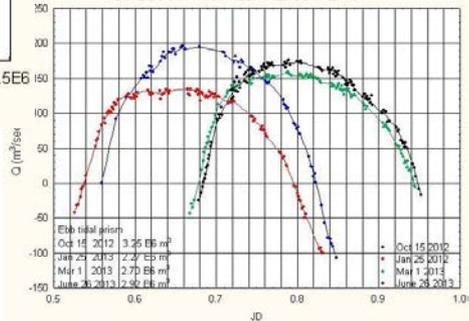
Boynton Inlet flow measurement system



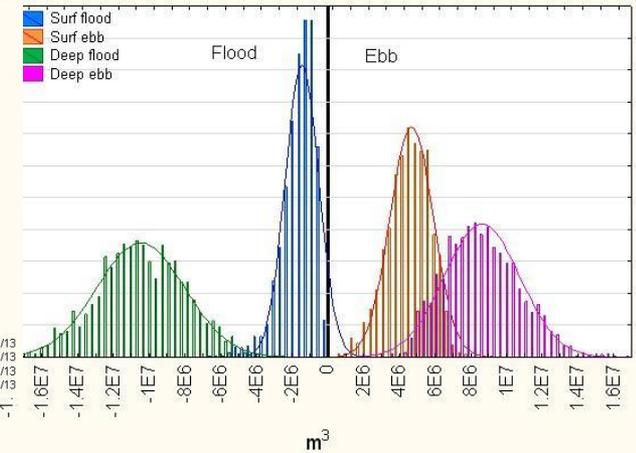
Hillsboro Inlet flow data



LAKE BOCA RATON FLOW MEASUREMENTS

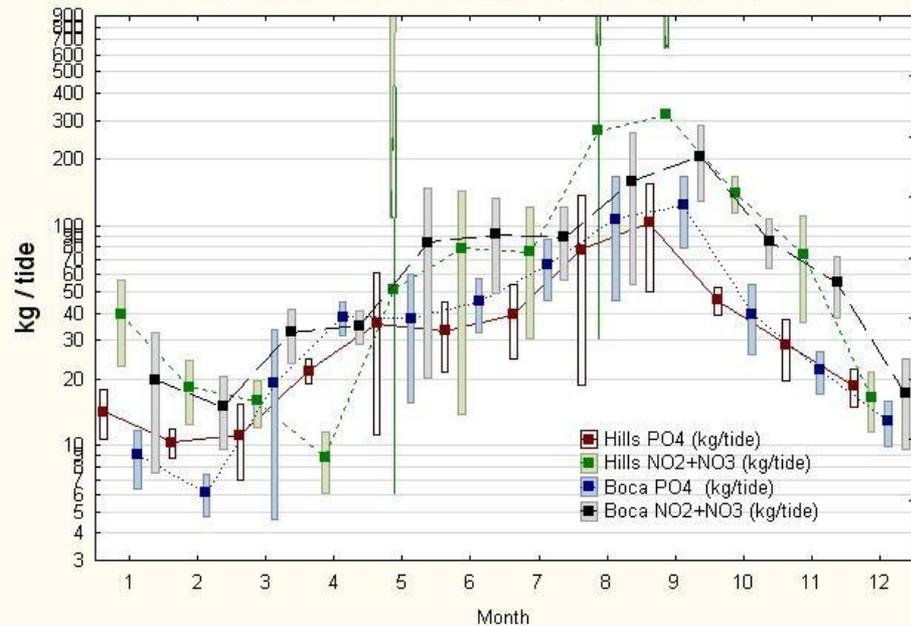


Port Everglades flow system
Total volume transport per tidal phase

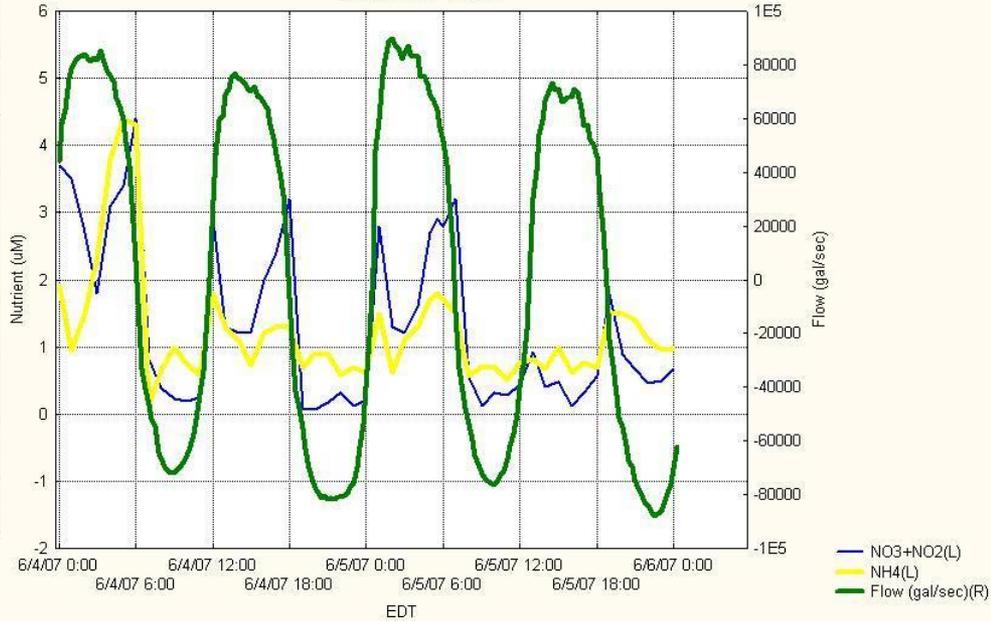


Nutrient fluxes from the inlets

Boca Raton and Hillsboro inlet nutrient flux

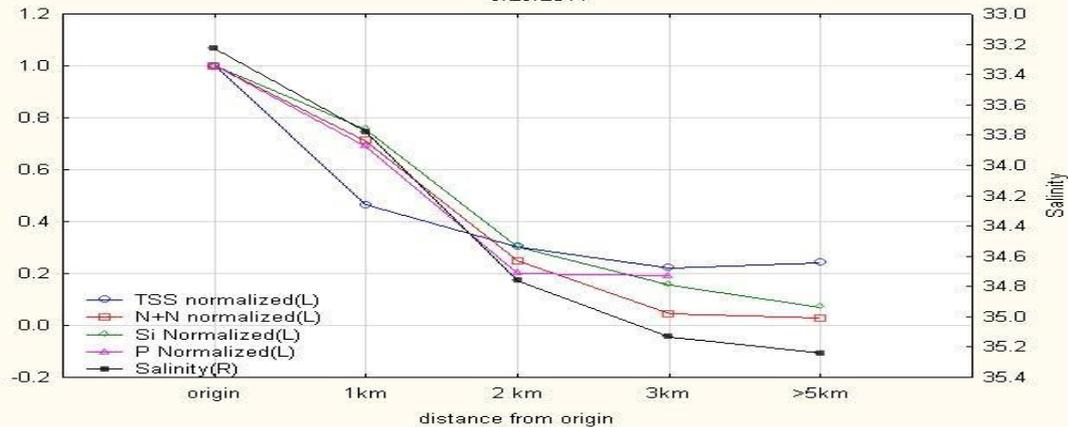


Boynton Inlet Nutrient study
Jun 4-6 2007
positive flow is seaward



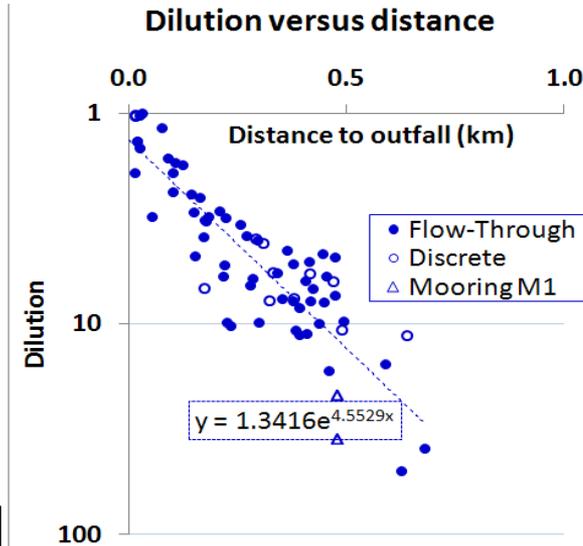
Port Everglades

normalized nutrient concentration at surface
9/29/2011

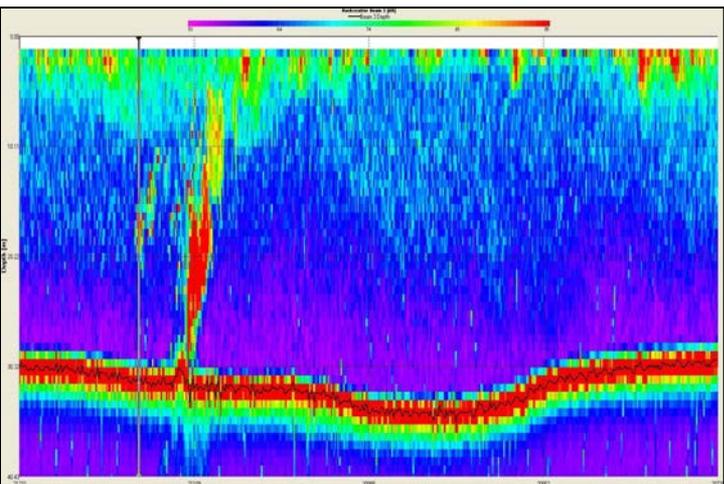


Ocean Wastewater outfalls

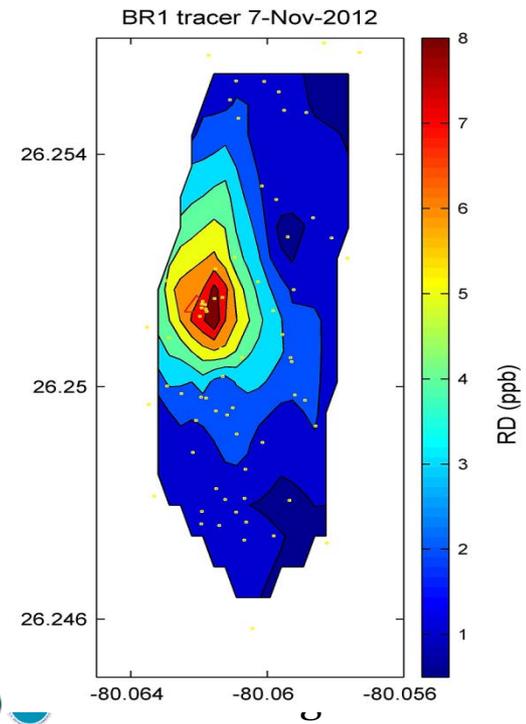
A variety of techniques are used to estimate the dispersal of materials from the outfalls



Rhodamine dye is used to track the dispersal of materials from the outfalls.

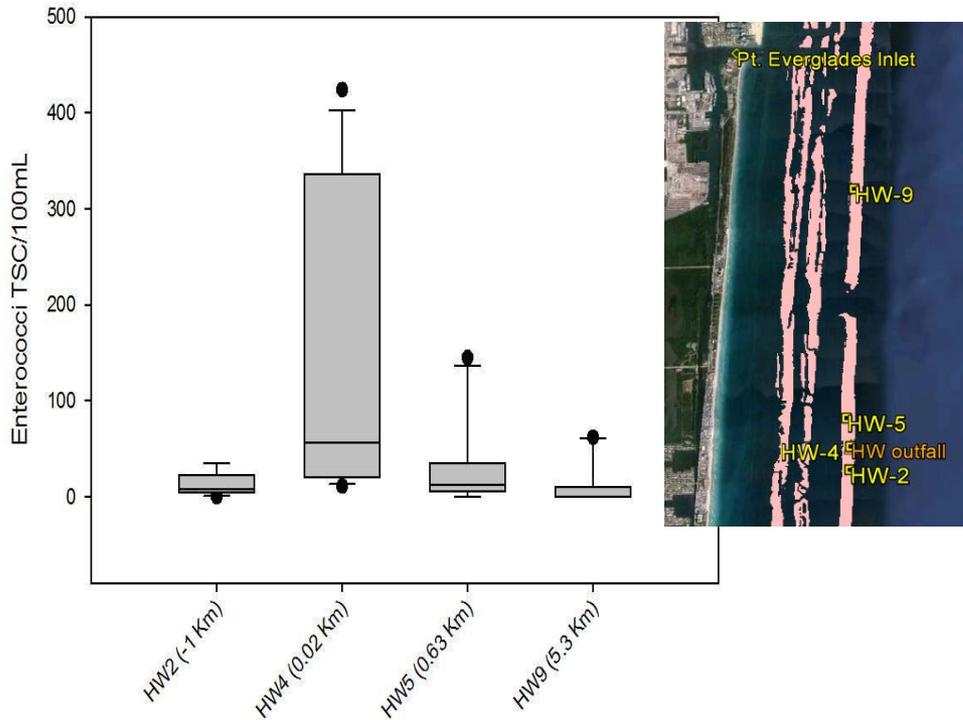


Acoustic backscatter imagery

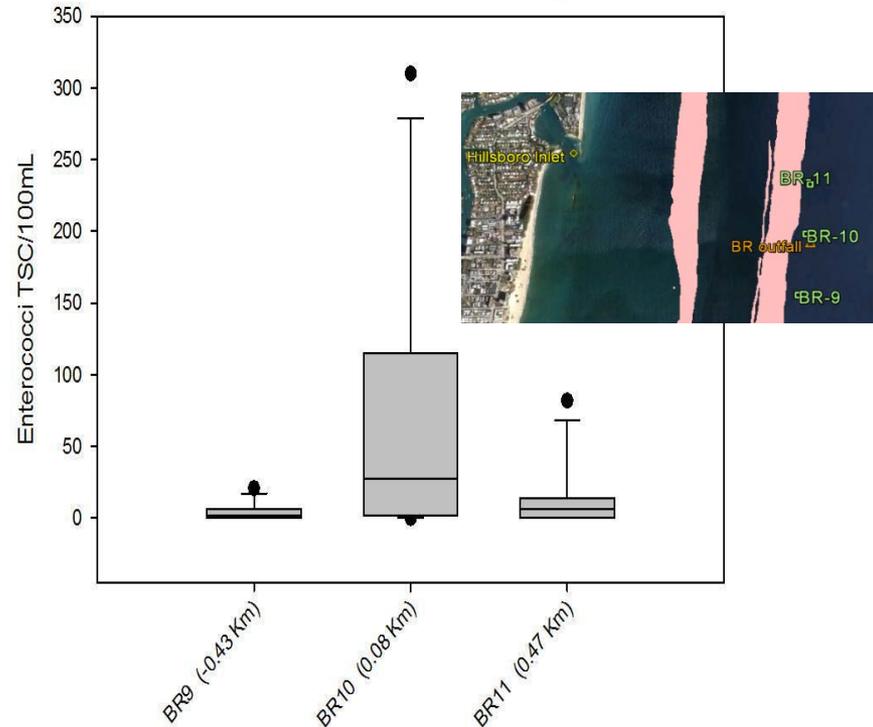


Total Enterococci by qPCR *vs.* Distance from outfalls

Hollywood Outfall - dilution of Enterococci qPCR signal with distance

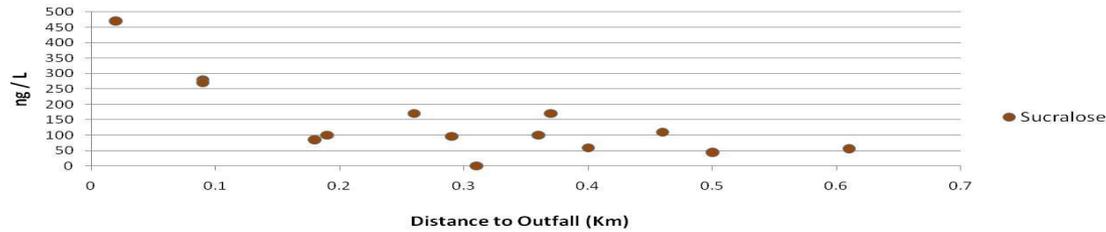


Broward Outfall - dilution of Enterococci qPCR signal with distance

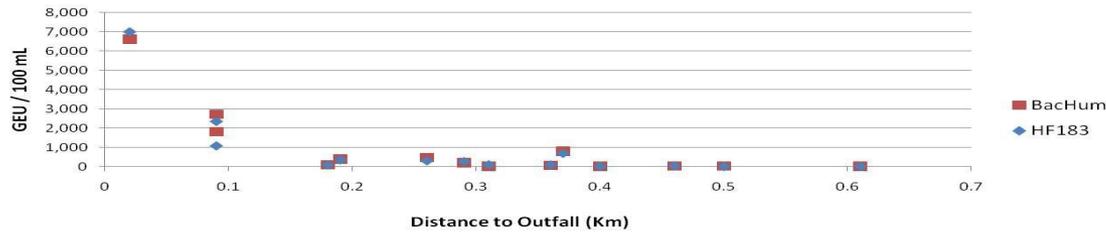


Cumulative monthly cruise data showing the decrease in abundance with distance from the outfall for total Enterococci (dead, dormant, and live) as measured by the Enterococcus qPCR assay at the Hollywood outfall (right) and Broward outfall (left).

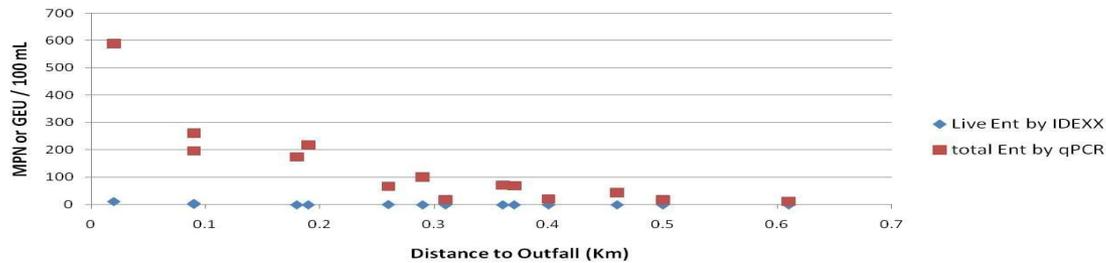
BOTEX1 - Sucralose human fecal marker measured by HPLC/TS/MS



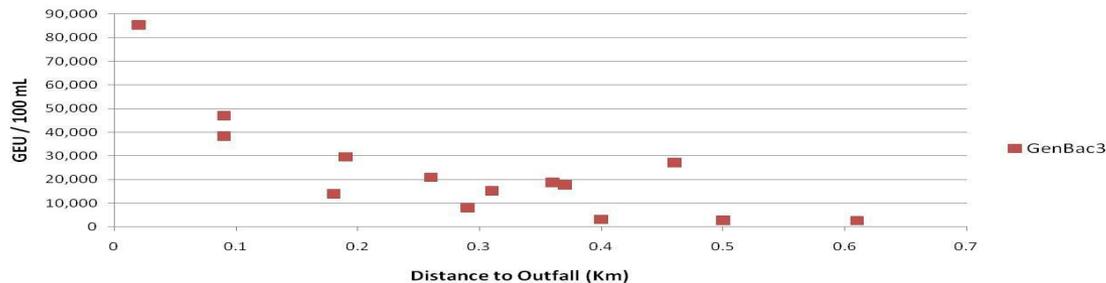
BOTEX1 - Human Bacteroidales measured by BacHum-UCD & HF183 qPCR



BOTEX1 - Viable Enterococci measured by IDEXX EnteroLert & Total Enterococci measured by Entero1A qPCR

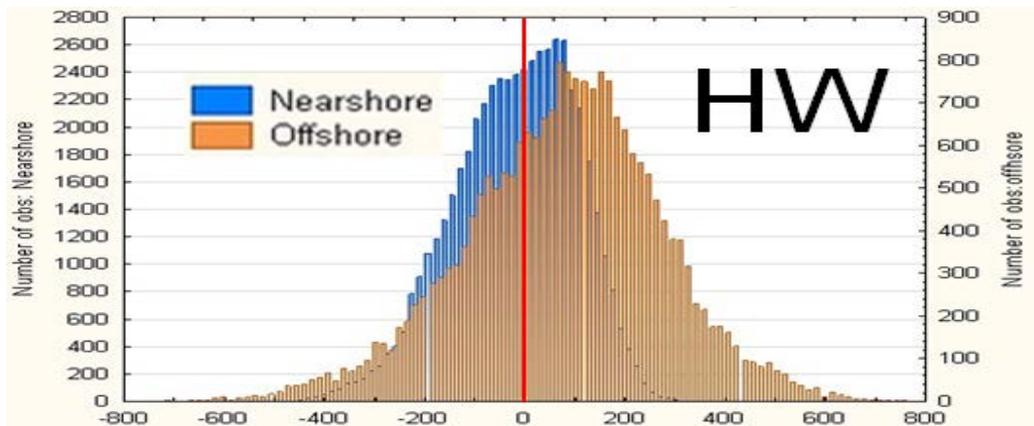
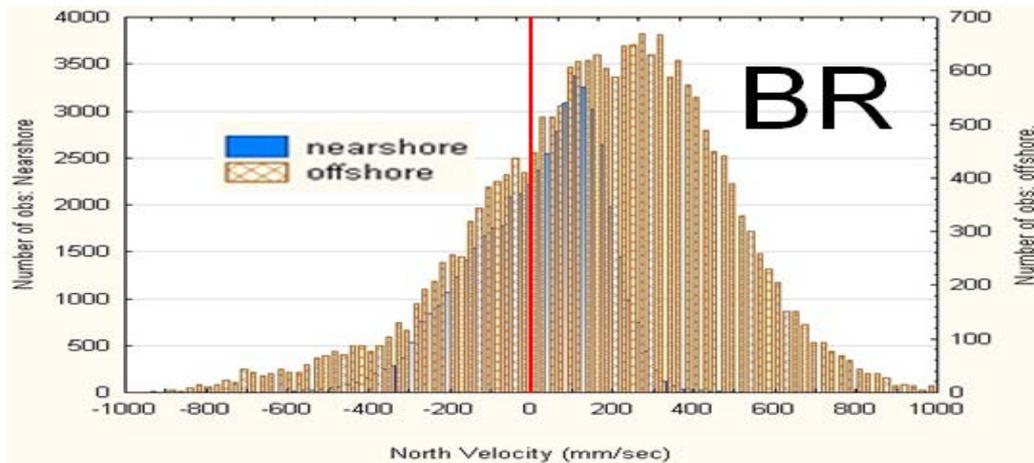


BOTEX1 - Total Bacteroidales measured by GenBac3 qPCR

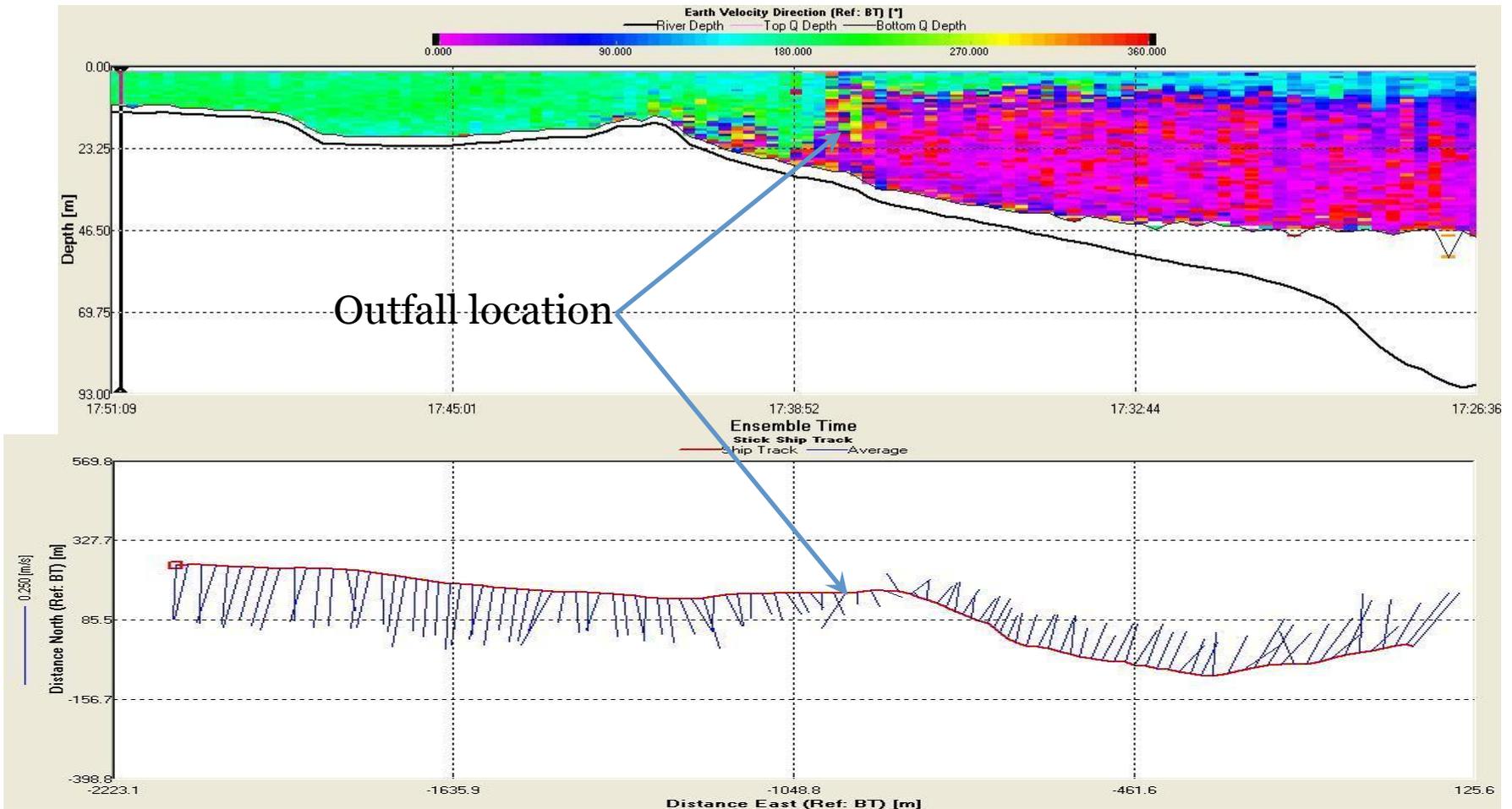


All microbial and fecal markers show rapid dilution with distance from the outfall.

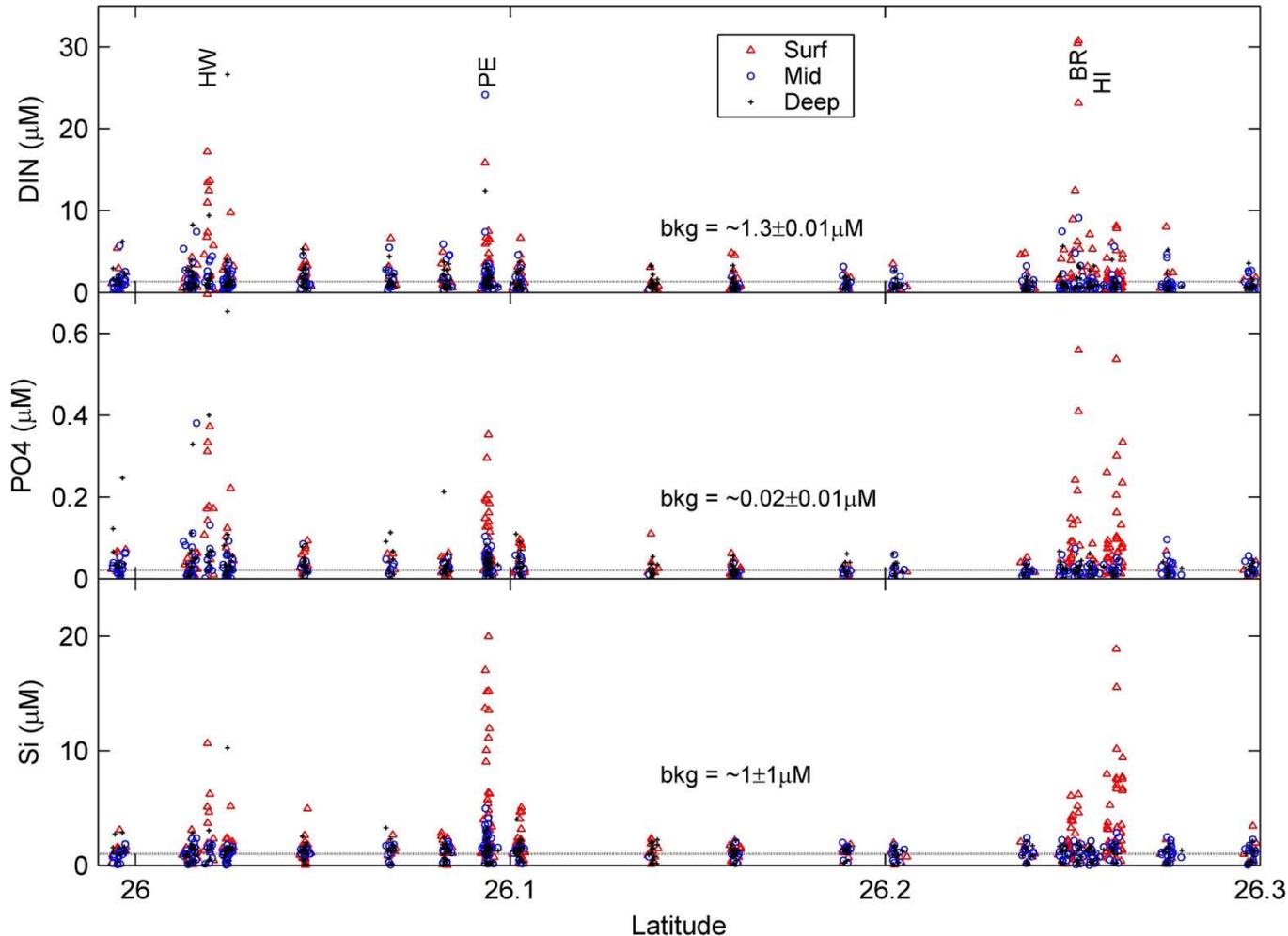
Time series of current measurements in shallow water show that southerly directed flow is more prevalent than had been expected



Near shore southern flow affects the dispersal of materials from outfalls (and inlets)

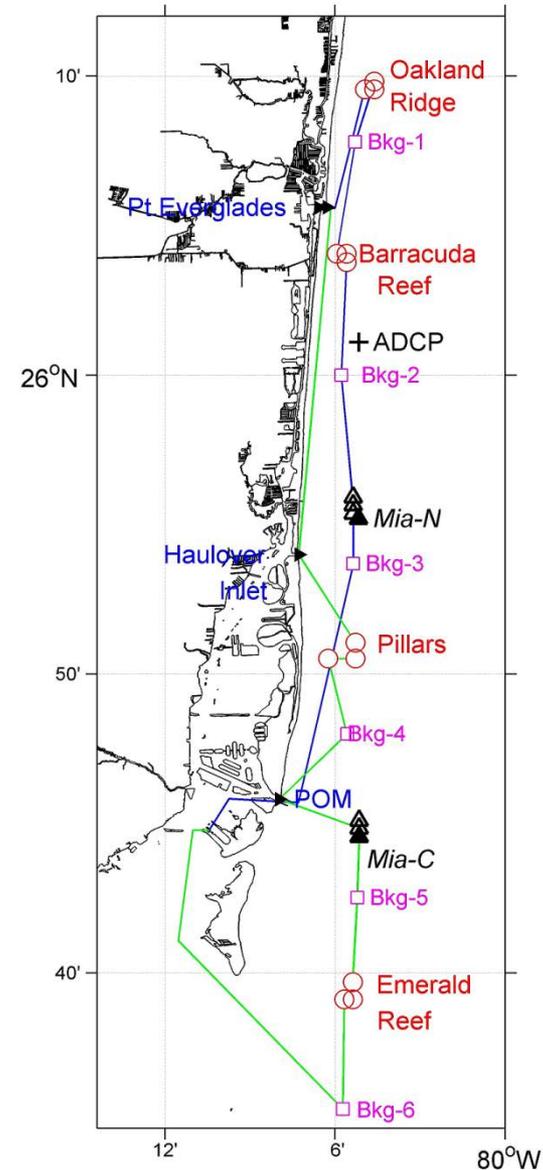


From completed studies, a synoptic picture of the nutrients levels in Southeast Florida coastal waters is emerging. This information enables managers to make informed decisions regarding the current state of the system and enables the development of meaningful regulatory standards.

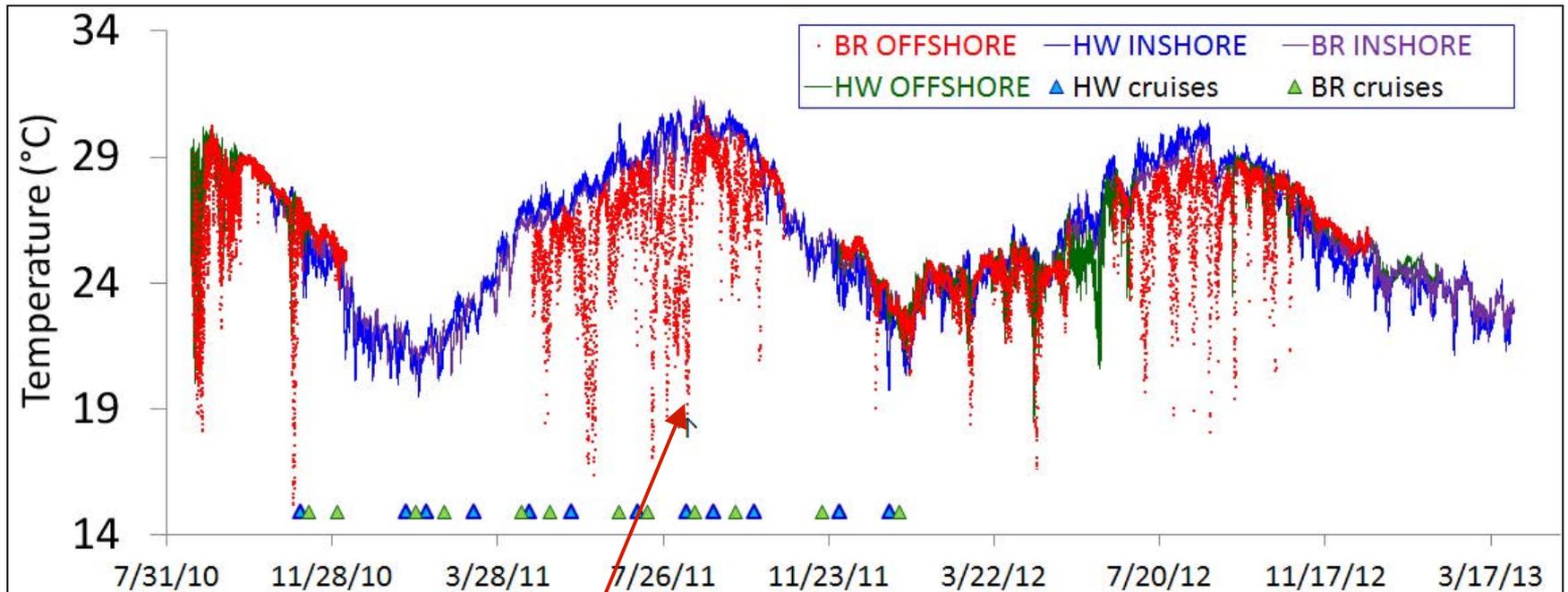


Current efforts are extending the study domain southward and including efforts to directly assess the effects of time varying nutrient concentrations and the proximity of known nutrient sources on coral health.

These data will be employed in the development of numeric nutrient criteria for the coastal waters of southeast Florida, in conjunction with the Florida Department of Environmental Protection.



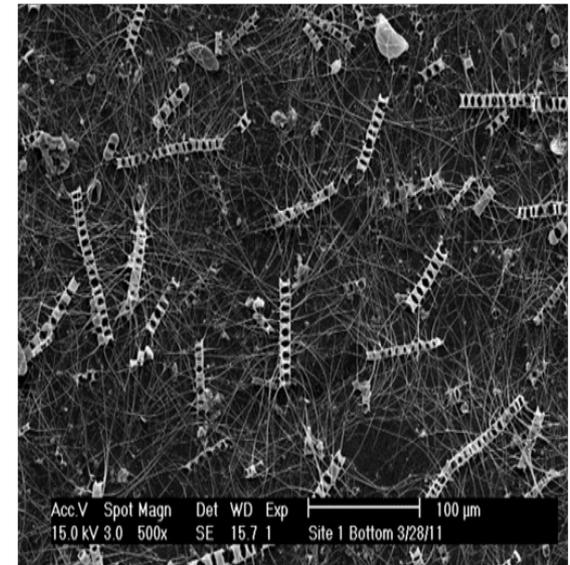
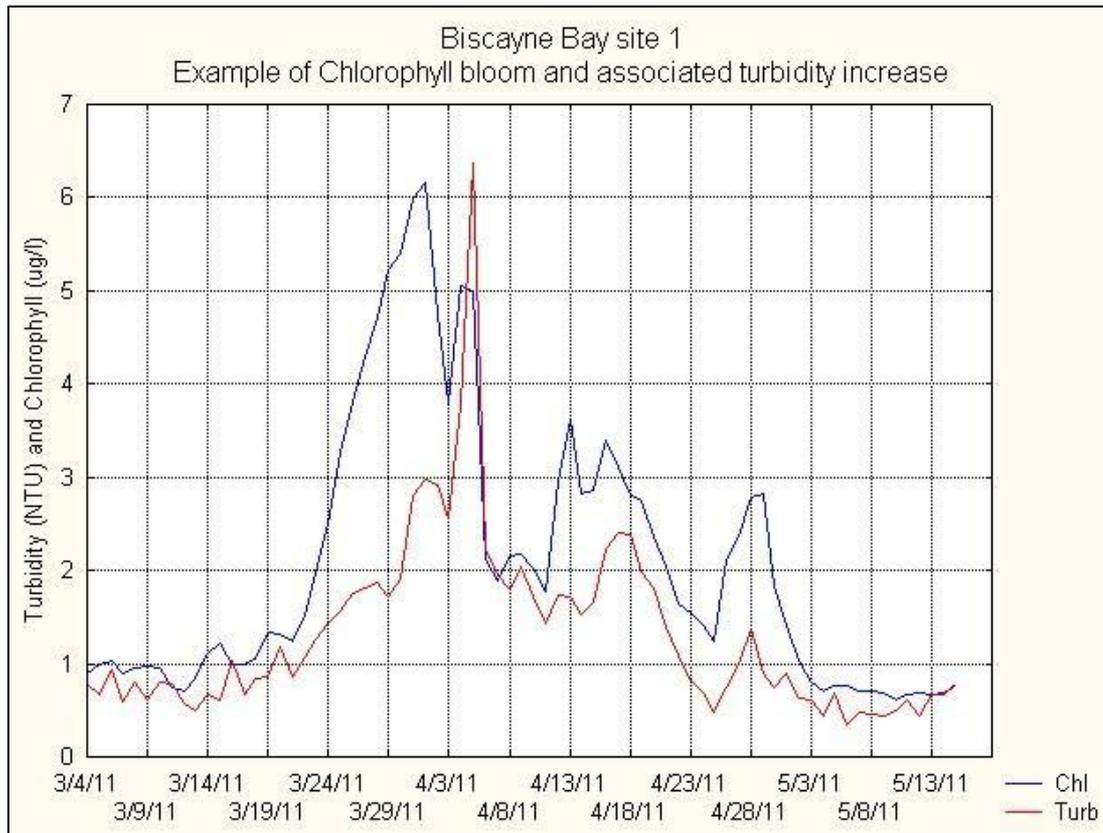
Non-anthropogenic nutrients sources modulate the nutrient concentrations in the coastal environment. Upwelling and groundwater are two such sources. Quantification of these sources is necessary and the focus of current studies.



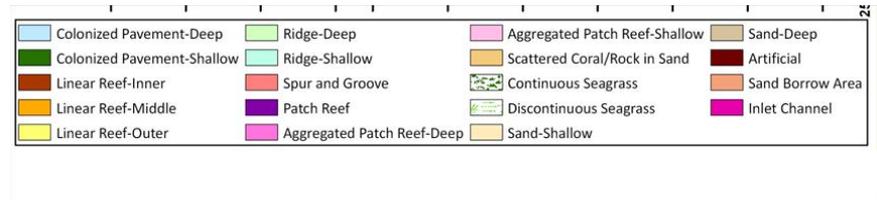
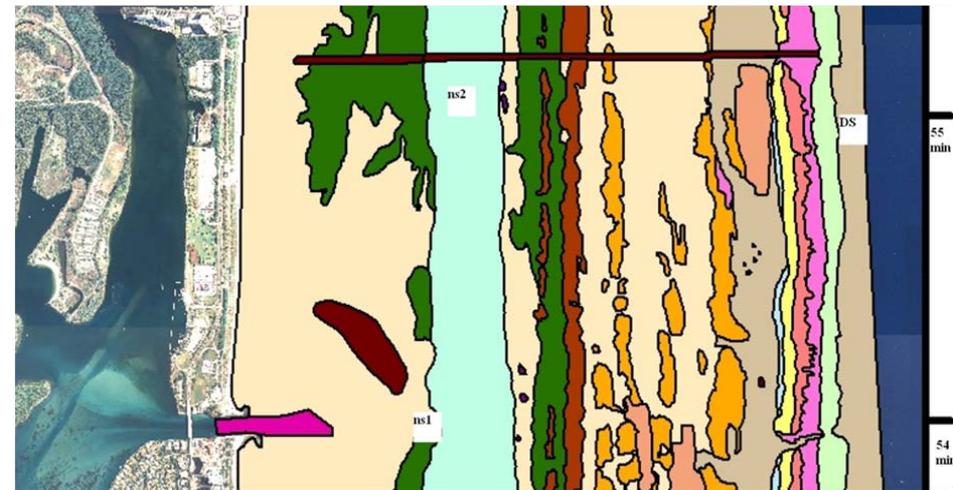
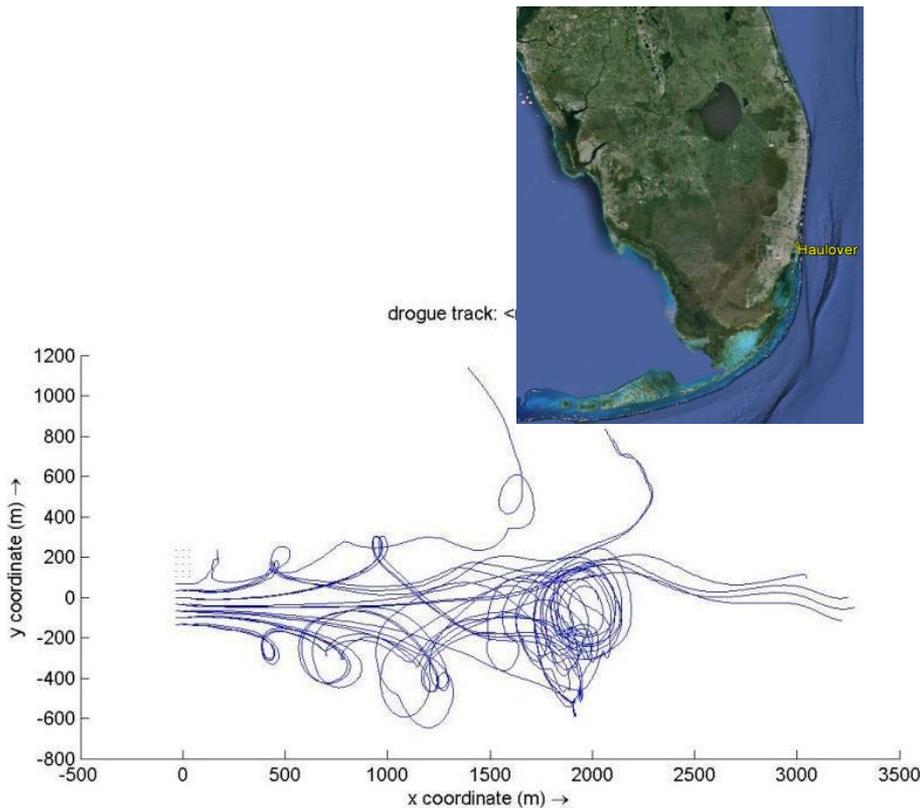
11-Aug-2011: Nearly 10°C drop in temperature with elevated NO₃ concentrations: indications of upwelling.

Nutrient inputs to Biscayne Bay promote phytoplankton blooms. These blooms increase ambient turbidity levels.

Throughout the United States and elsewhere, ambient turbidity levels are used in the regulation and monitoring of marine construction projects.



Future efforts planned include applying the Delft-3D model coupled with the University of Miami HYCOM model to simulate the dispersion of material from the Baker's Haulover inlet and the Miami –Dade North outfall into the coastal waters near Miami.





Questions?

